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# Frailty Assessment and How to Define Futile TAVR

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# Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

## **Affiliation/Financial Relationship**

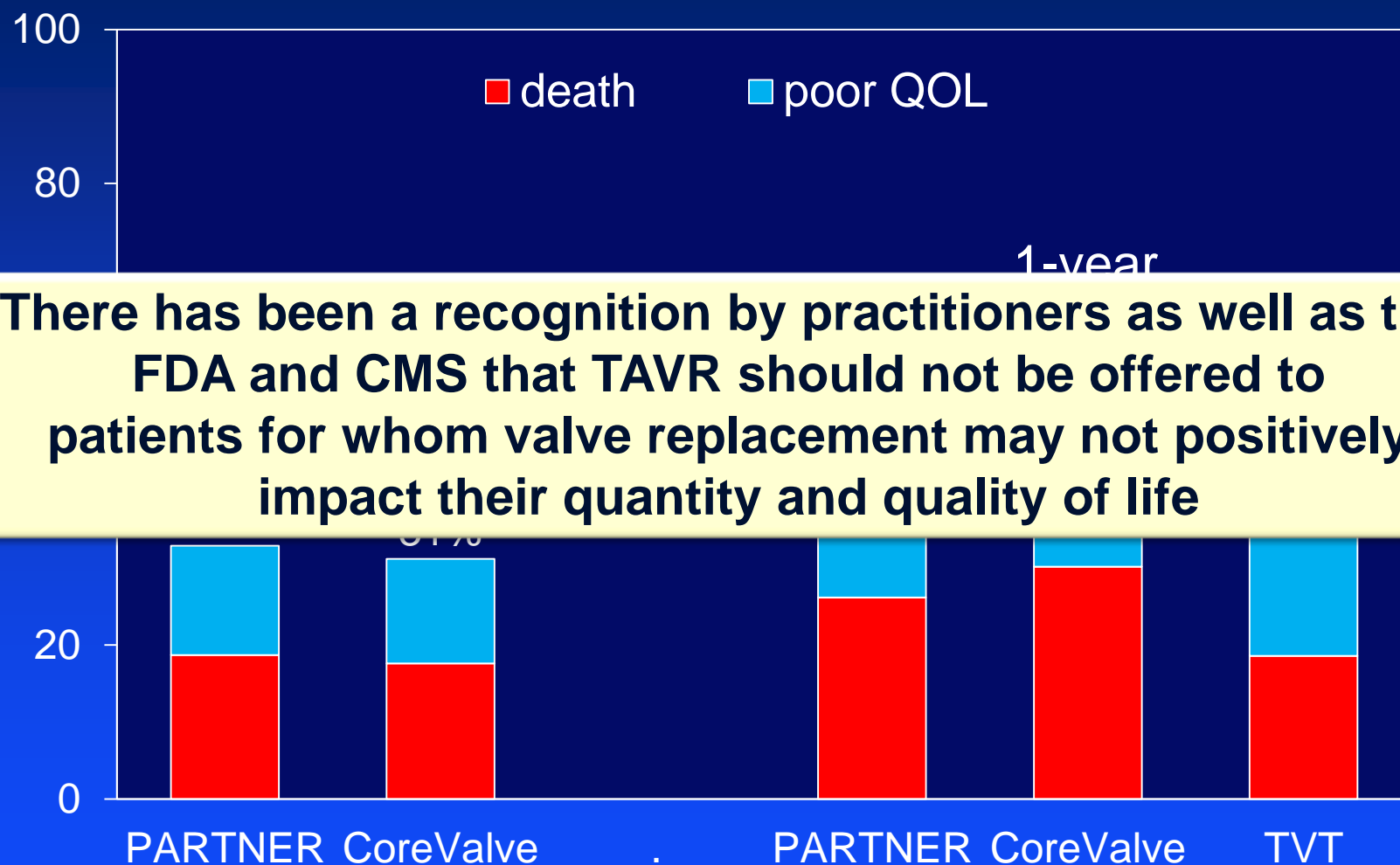
- Grant/Research Support
- Grant/Scientific Advisory Board
- Executive Physician Council

## **Company**

- Edwards Lifesciences
- Medtronic
- Boston Scientific Corp



# Outcomes After TAVR



# When should a procedure not be performed?

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Perspective	General Principle	Application
Patient	A procedure should not be performed when the expected benefits do not outweigh the potential harm	Shared Decision Making Appropriate Use Criteria

# When should a procedure not be performed?

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Perspective	General Principle	Application
Patient	A procedure should not be performed when the expected benefits do not outweigh the potential harm	Shared Decision Making Appropriate Use Criteria
Society	A procedure should not be performed when its expected costs (including induced costs) could provide greater benefit in an alternative use	Guidelines Coverage and Reimbursement Policy

*When should we not perform TAVR?*

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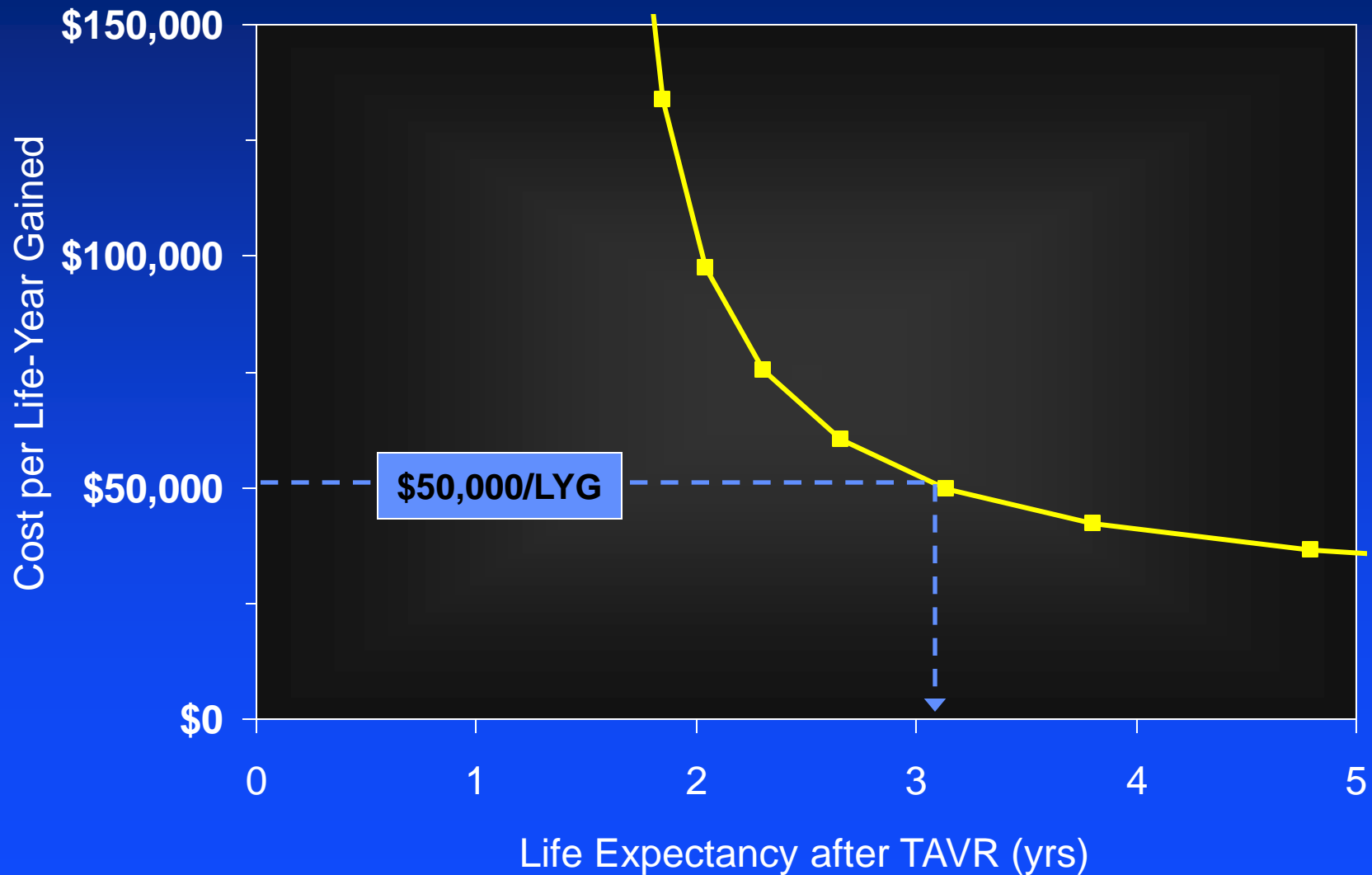
# Societal/Economic Perspective

# When is TAVR Not Cost-Effective?

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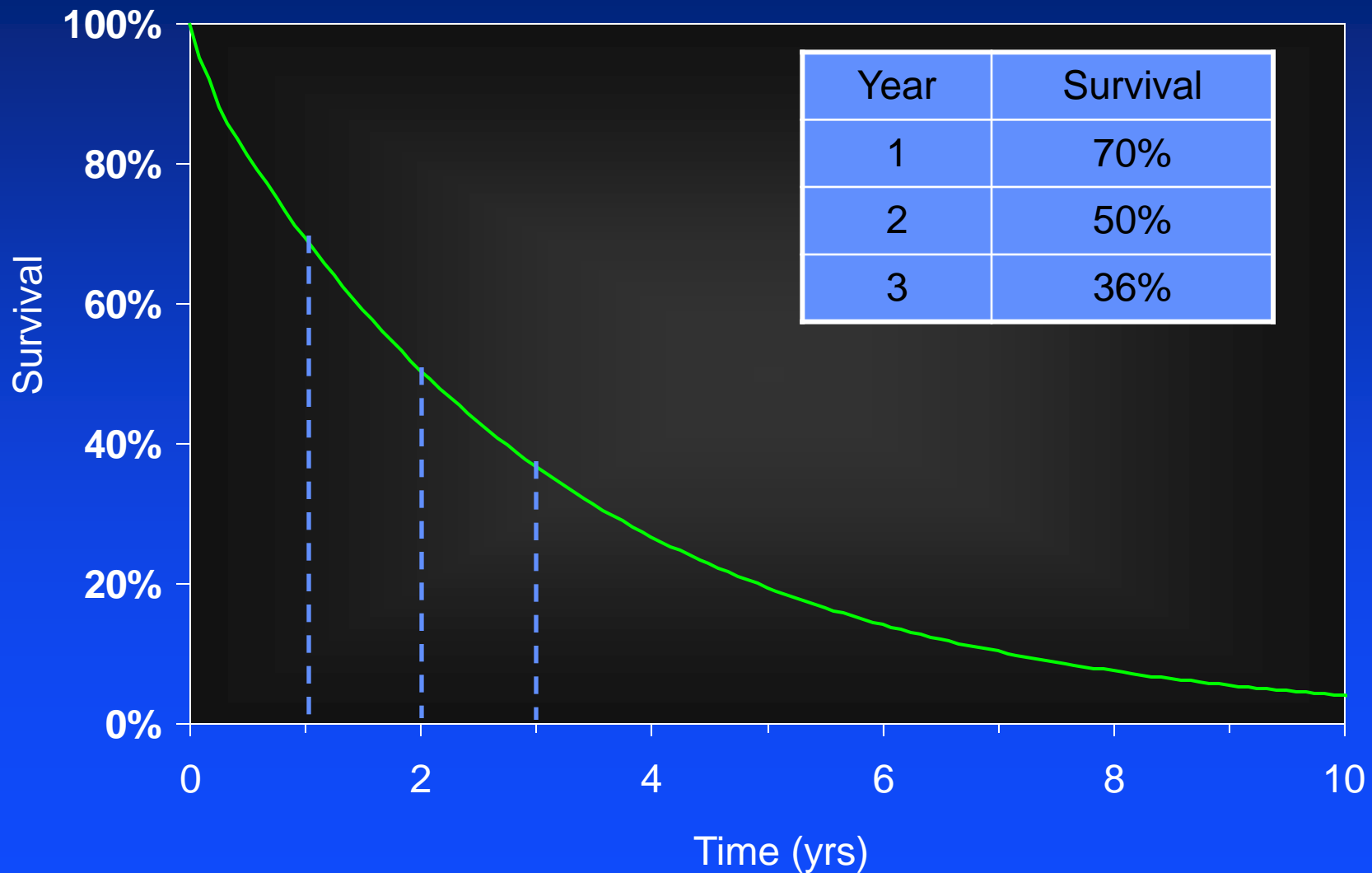
*When life expectancy after TAVR is  
less than ~3 years*

# Relationship between Cost-Effectiveness and Post-TAVR Life Expectancy





# What does a life-expectancy of 3 years look like?



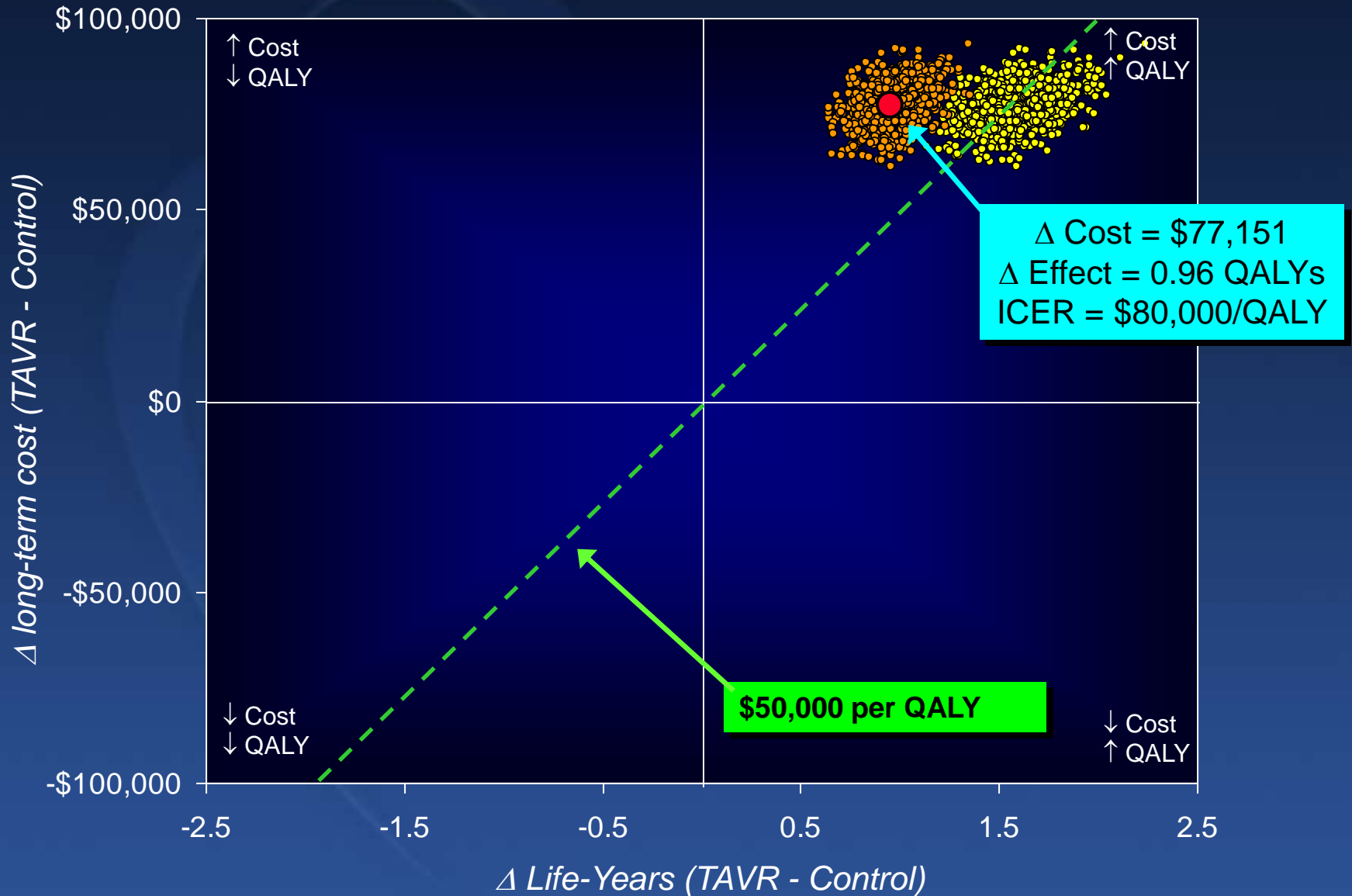
# When is TAVR Not Cost-Effective?

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*When quality of life is not expected to  
improve after TAVR*

# Cost-Effectiveness of TAVR vs. Medical Rx

## Sensitivity Analysis: No QOL Improvement



*When should we not perform TAVR?*

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# Individual Patient Perspective

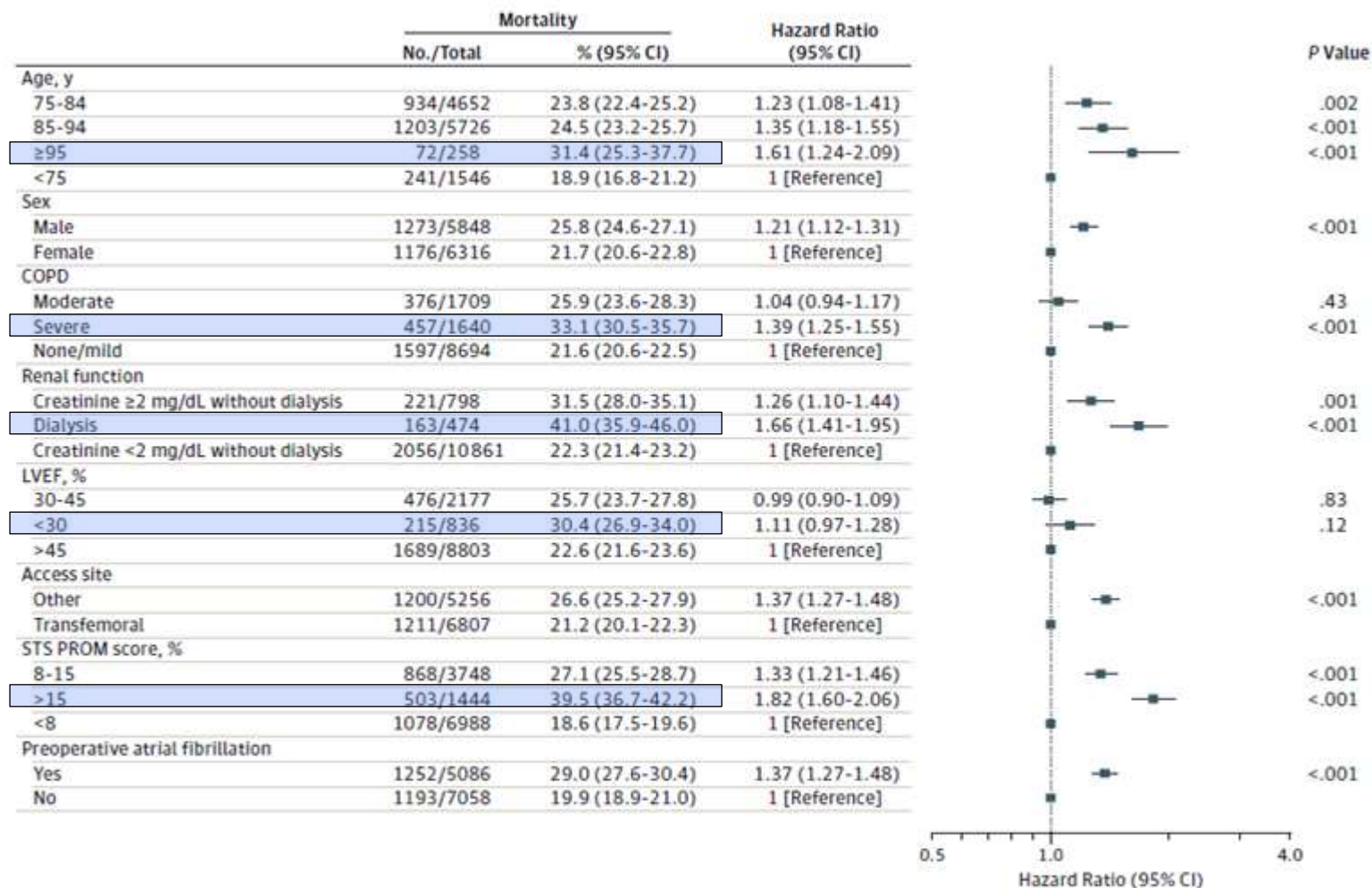
# When is TAVR Futile?

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*No single risk factor is sufficient to  
identify “futility”*

# Impact of Baseline Factors on 1-Year Mortality

Figure 2. Multivariate Risk-Adjusted Outcome of Mortality



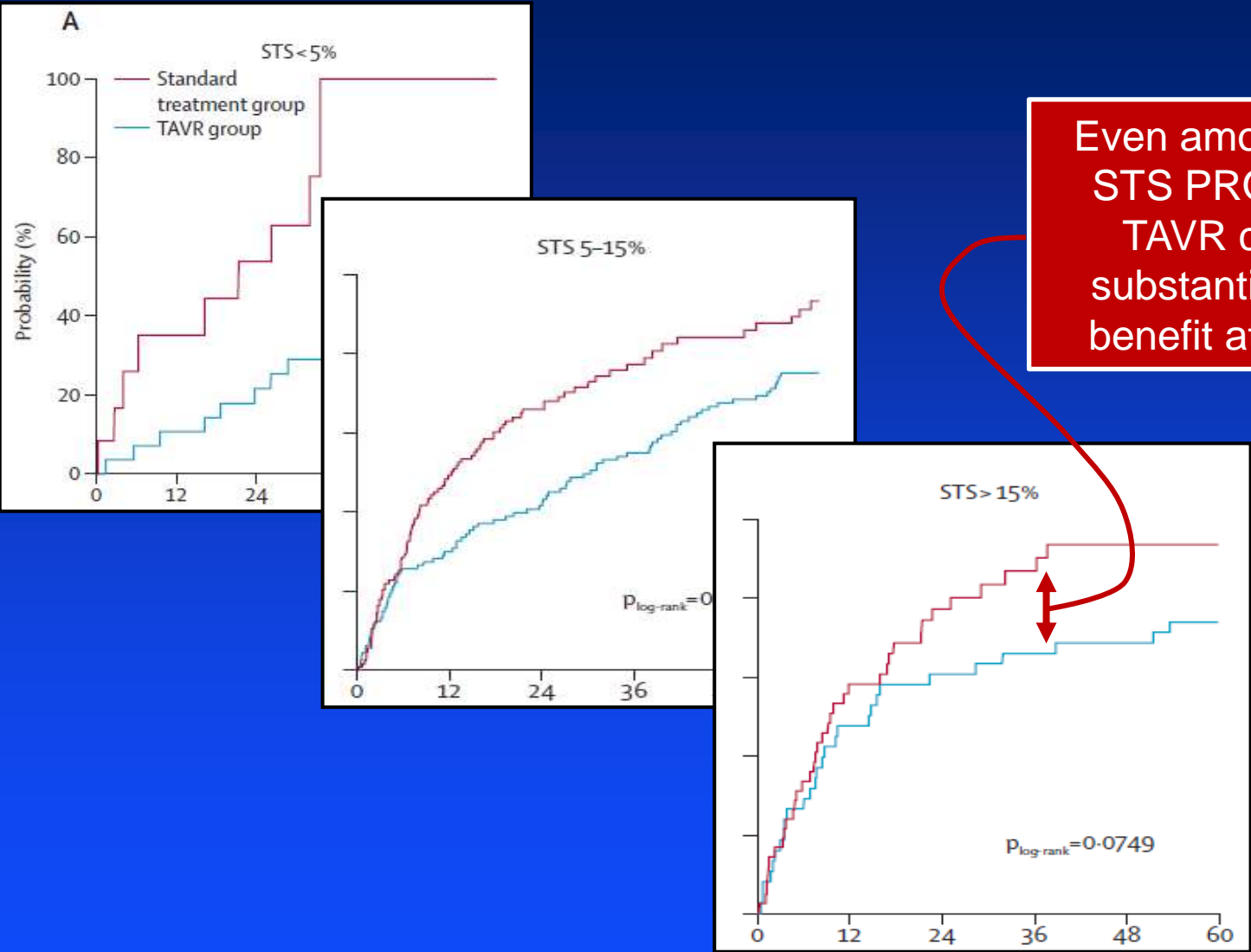
COPD indicates chronic obstructive pulmonary disease; LVEF, left ventricular ejection fraction; STS-PROM, Society of Thoracic Surgeons Predicted Risk of Mortality.

# When is TAVR Futile?

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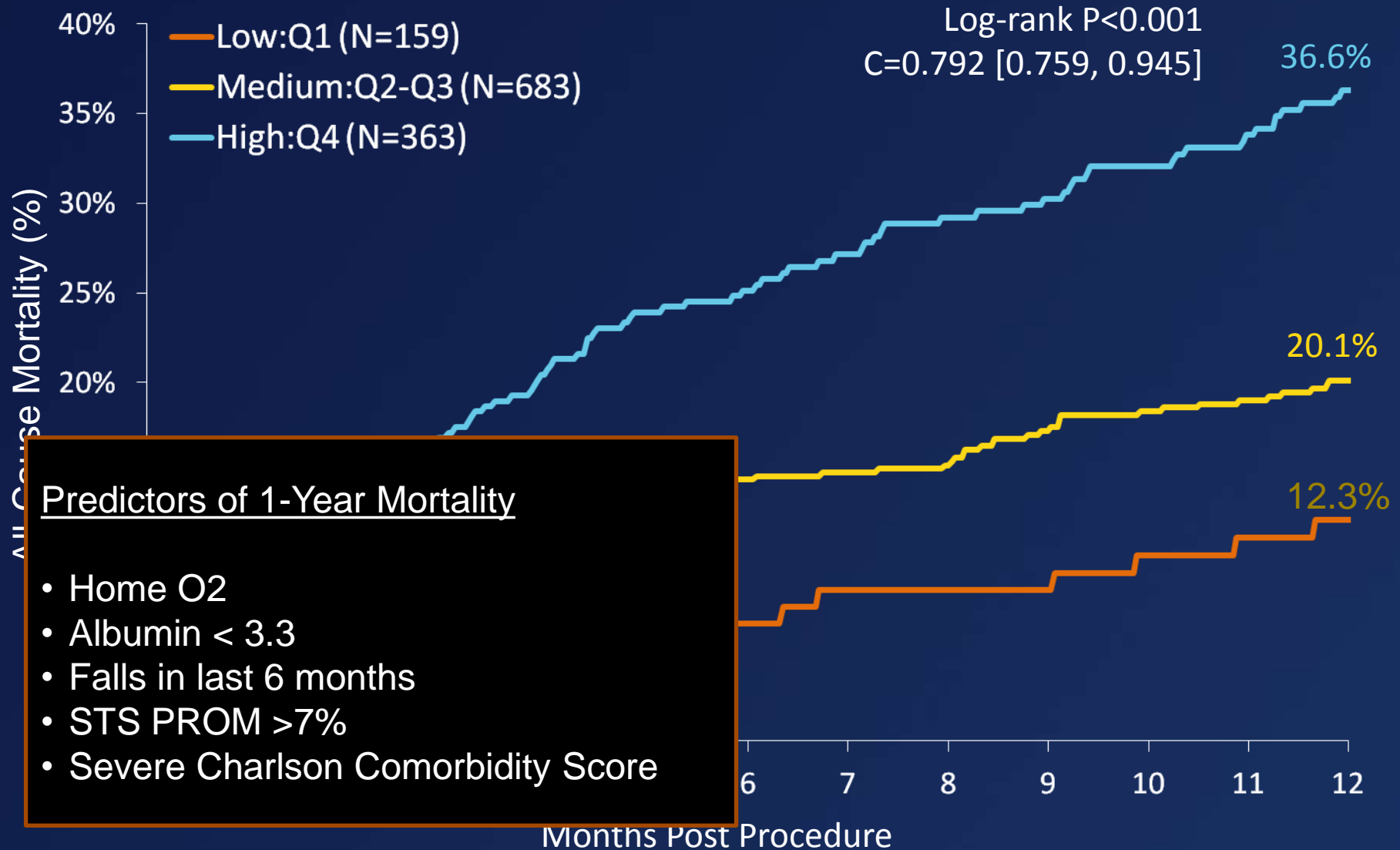
*Combinations of risk factors improve prediction, but still may not be sufficient*

# Identifying Futility in TAVR: STS PROM

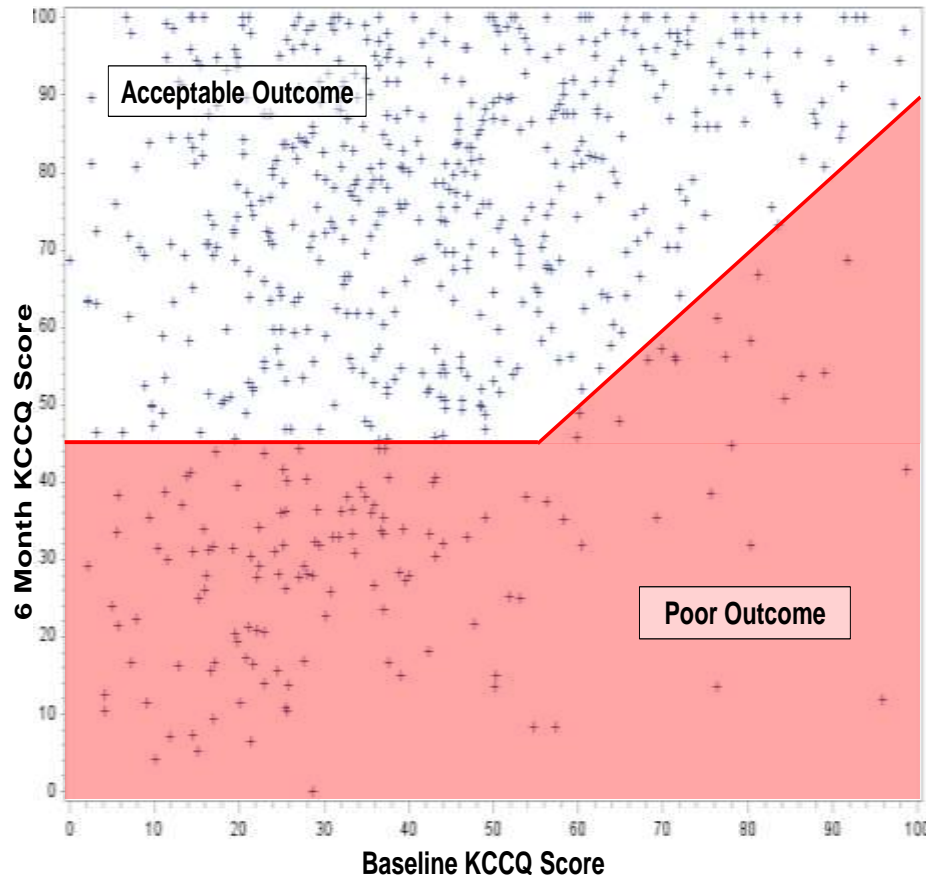




# 1-Year Mortality by Risk Level

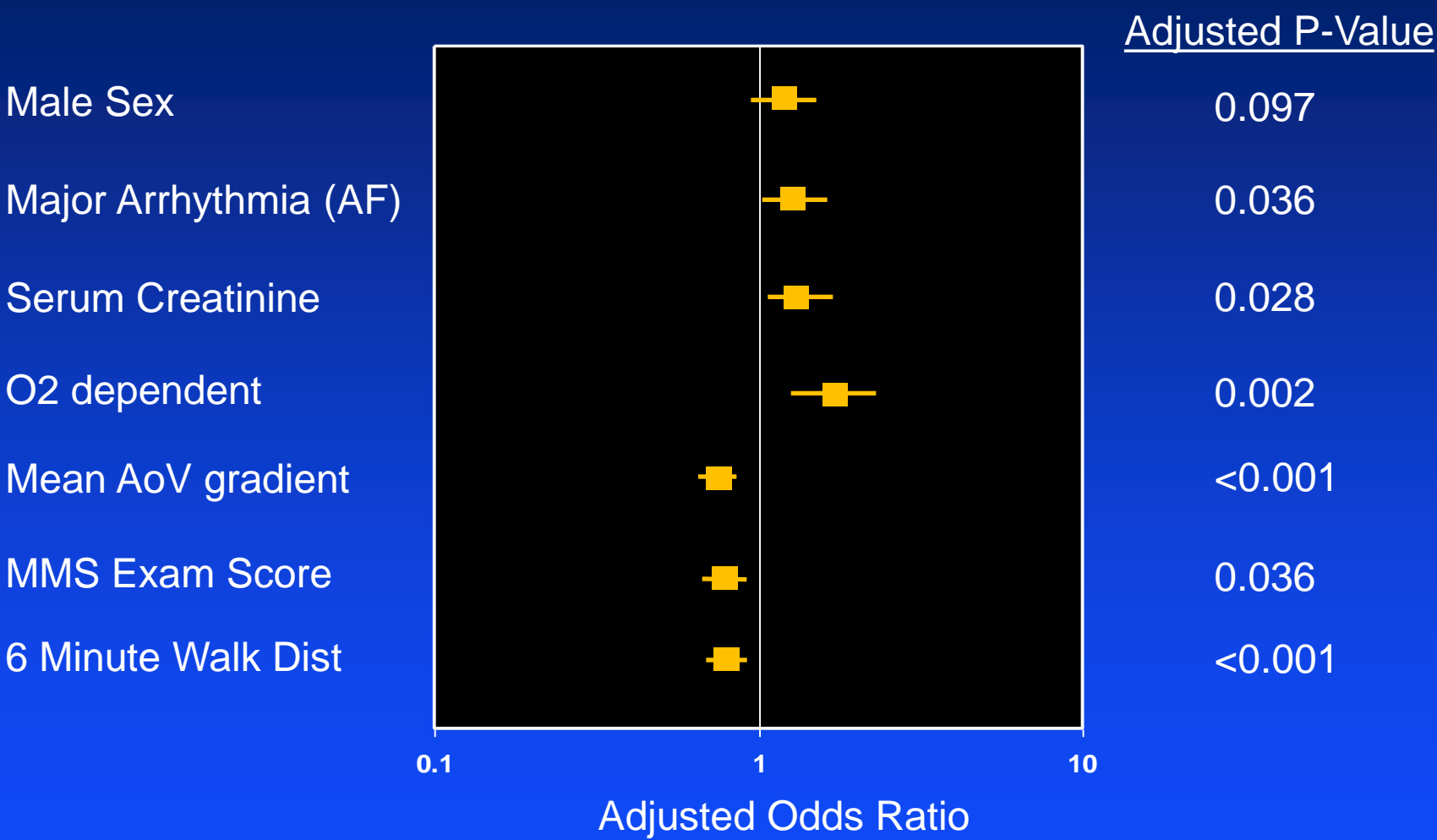


# Poor Outcome: Conceptual Framework



- For patients at high risk of surgical AVR, a poor outcome should include both a mortality and a QOL component
- Conceptual analysis of PARTNER trial data suggest that a reasonable definition might be:
  - *Death within 6 months*
  - *Persistent KCCQ-OS <45*
  - *KCCQ-OS decrease of > 10 points vs. baseline*

# Predictors of Poor Outcome



\* Poor Outcome: (1) Death within 6 months; (2) KCCQ-OS < 45; or KCCQ-OS decrease more than 10 points vs. baseline

# Frailty



- A syndrome of impaired physiologic reserve and decreased resistance to stressors which is associated with a poor prognosis...
  - In the general population
  - In the elderly with CAD
  - In the elderly after general or cardiac surgery
  - After TAVR (small single center studies)

# ***Eyeball Test for Frailty Assessment***

***Patient A***



***vs.***

***Patient B***



Same age and predicted risk  
One passes the “eyeball test” – one does not

Photos courtesy of Michael J. Mack, MD  
Medical City Dallas

# Primary Predictor Frailty Score



Frailty Domain	Measure	Frailty Score
<b>Slowness</b>	15 foot walk gait speed (m/s)	Quartiles (0-3)
<b>Weakness</b>	Grip strength (kg)	Gender based quartiles (0-3)
<b>Wasting and malnutrition</b>	Serum albumin (g/dl)	Quartiles (0-3)
<b>Inactivity</b>	Katz ADLs (dress, bath, transfer, feed, toilet, continence)	Any dependence=3, Independence=0

**Score range 0-12**  
**12 = most frail**  
**0 = least frail**

*Green, Am Coll Cardiol Interv. 2012;5(9):974*

# Outcomes

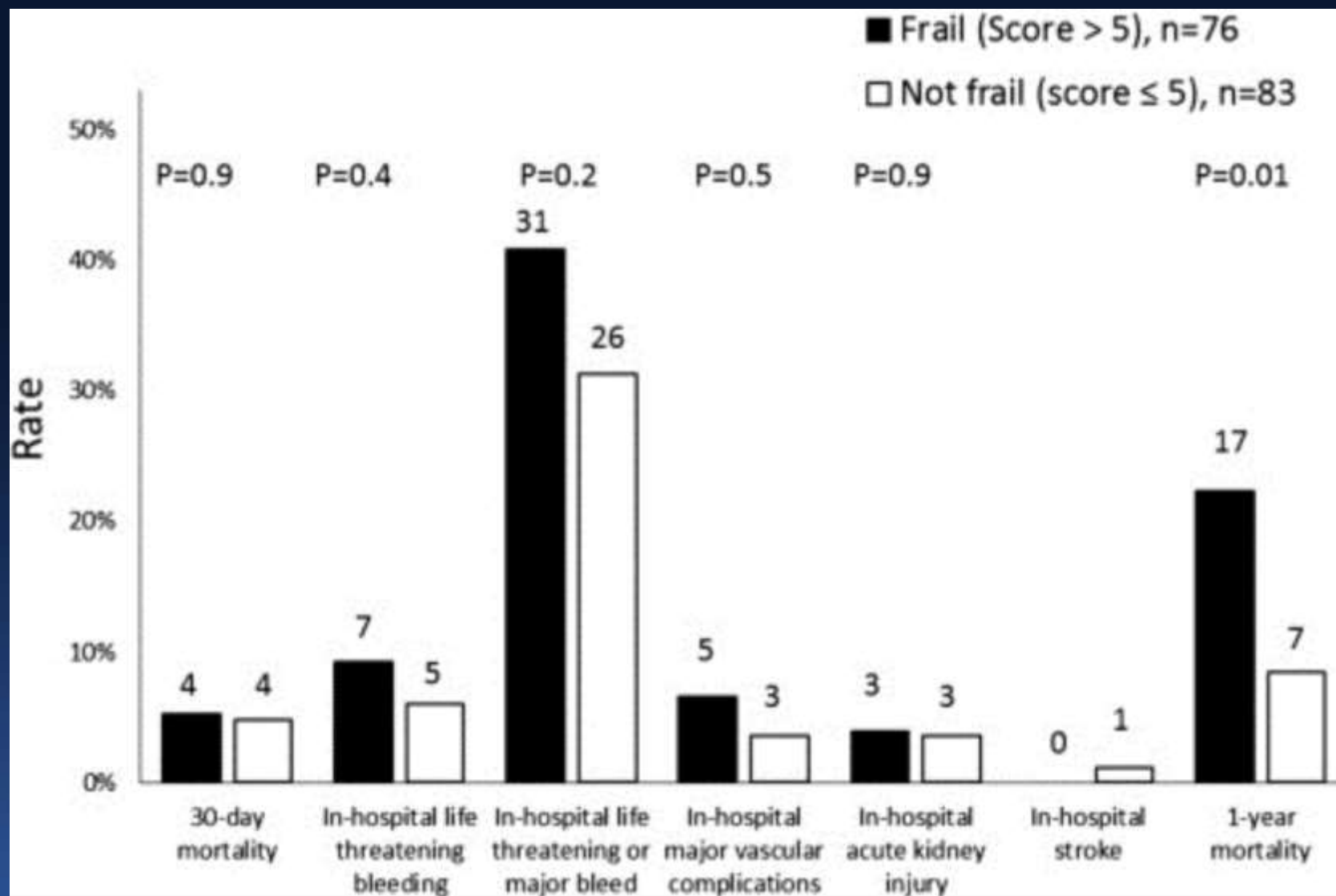


- 1 year death from any cause
- Poor outcome (Arnold et al)
  - Considers mortality and quality of life
  - Success is defined as alive with acceptable or improved QOL
  - Poor outcome is defined as dead or with significant reduction in QOL (KCCQ reduced by 10 ~ 1 NYHA functional class) or KCCQ < 40 (class IV CHF)

*Arnold SV. Circ Cardiovasc Qual Outcomes. 2013 Sep 1;6(5):591*  
*Arnold SV. Circulation. 2014 Jun 24;129(25):2682*



# Unadjusted Clinical Outcomes





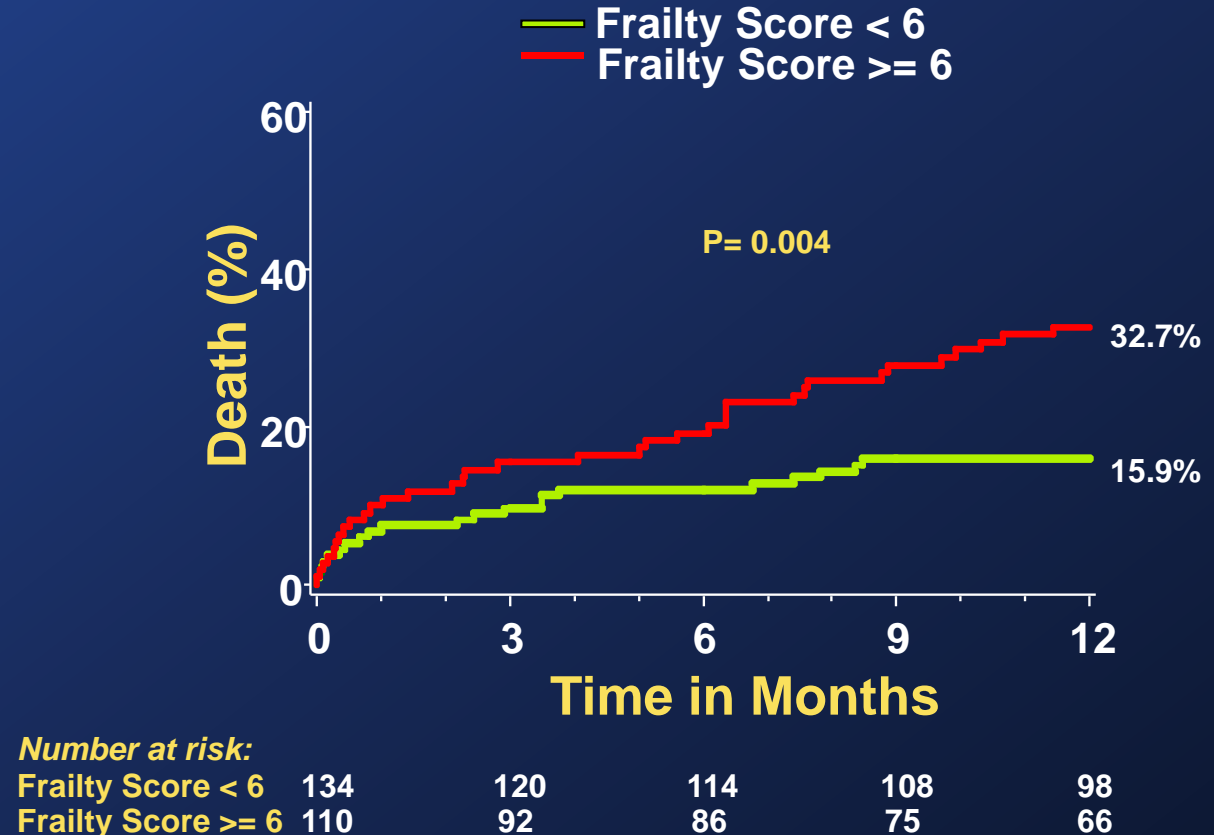
# Kaplan-Meier Survival Estimates Stratified by Frailty Score



*After adjusting for important clinical and demographic characteristics, frailty remained independently associated with...*

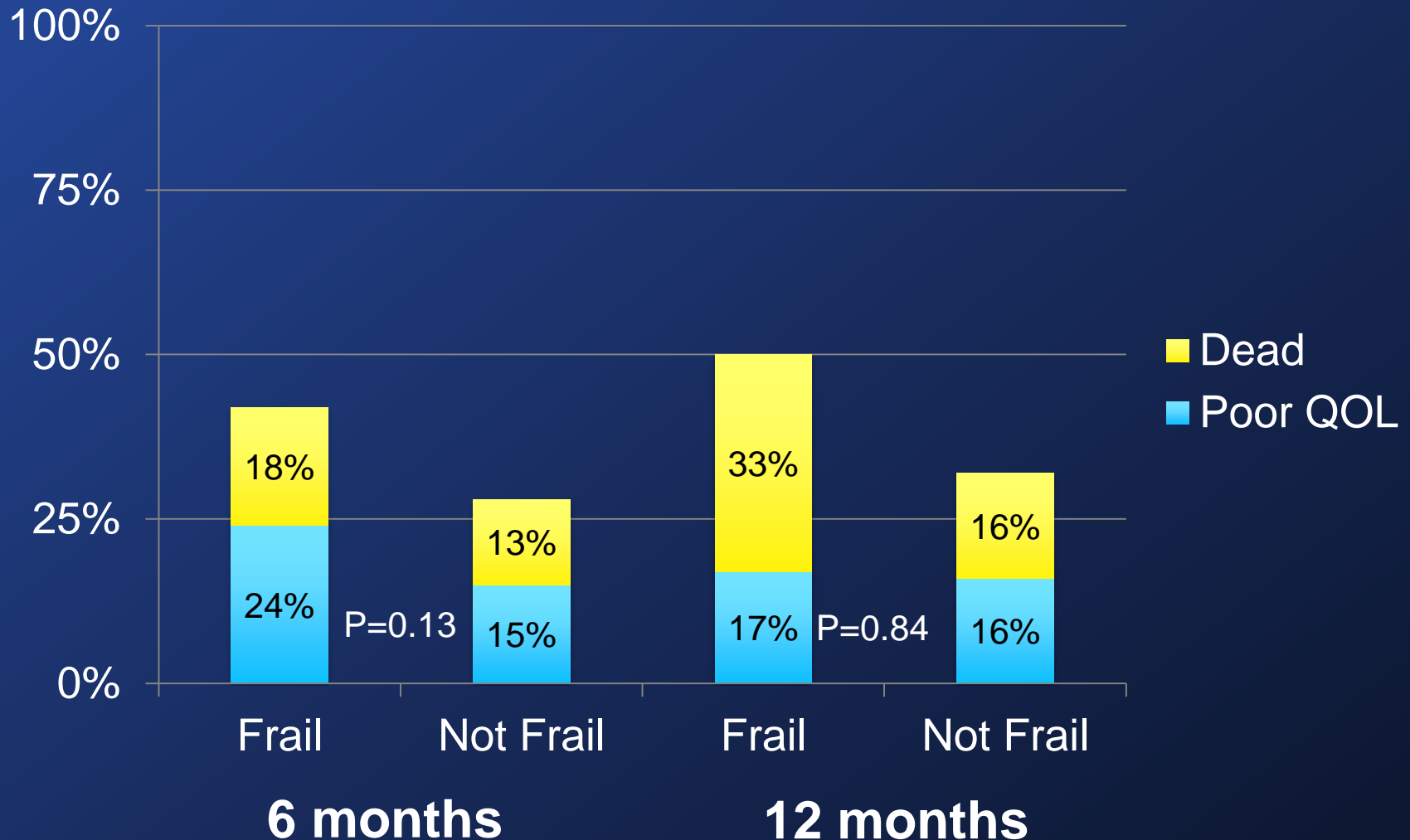
**2.5-fold increased hazard of 1-year mortality after TAVR**

(95% CI 1.40-4.35,  $p=0.002$ ).



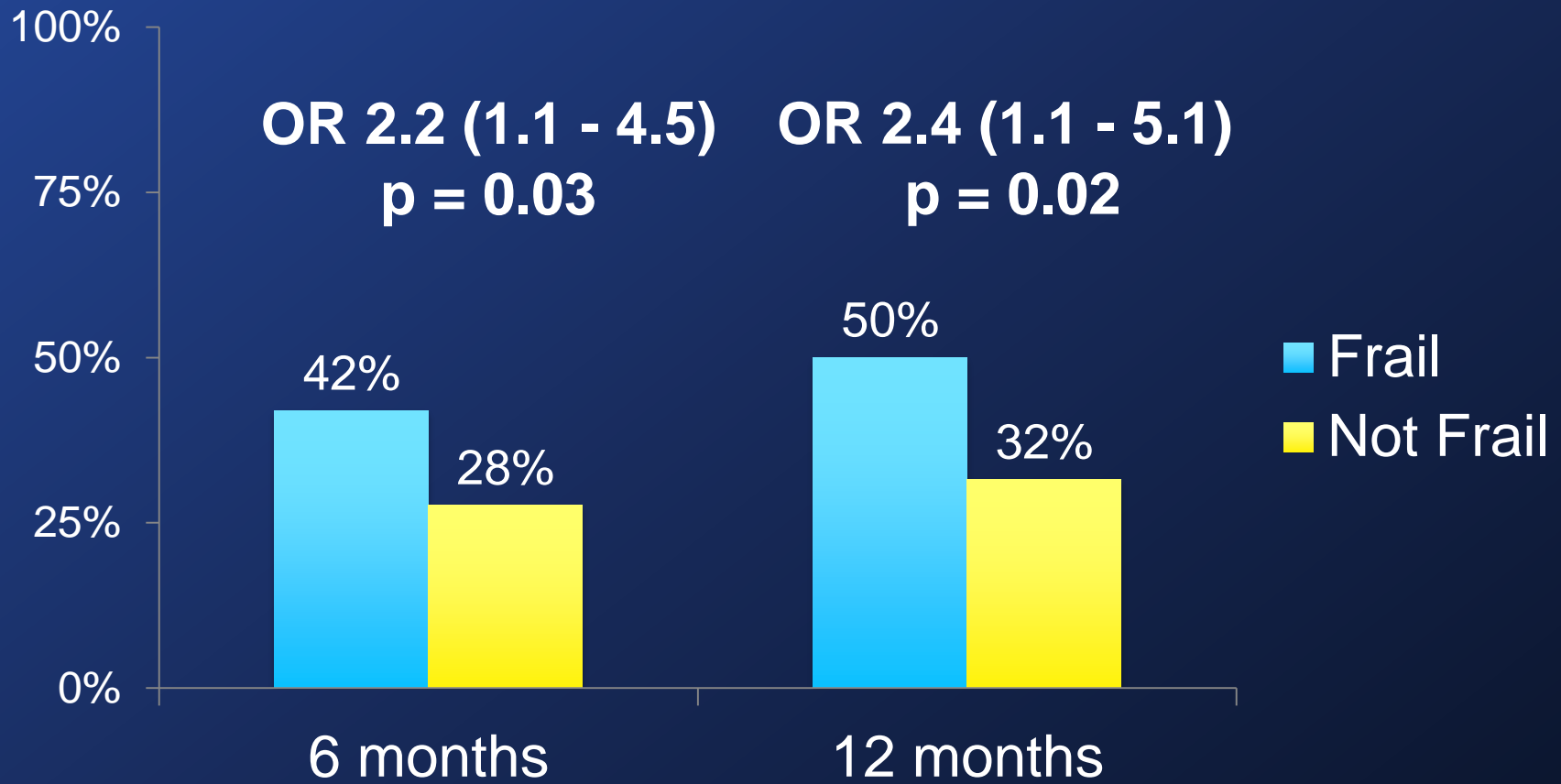
# Poor Clinical Outcome

Separating death and  
Poor QOL (KCCQ < 40 or decrease > 10)



# Poor Clinical Outcome

Dead, decrease in KCCQ > 10, or KCCQ < 40



# Markers of Frailty and Mortality at 1 year



Variable	HR (95% CI)	p-value
Gait speed (m/s)*	1.37 [0.53-3.45]	0.51
Grip strength (kg)*	1.02 [0.99-1.05]	0.28
Albumin (g/dL)*	1.25 [0.88-1.79]	0.21
Any ADL limitation	1.59 [0.93, 2.70]	0.09
Score (continuous)*	1.12 [1.02, 1.22]	0.01
Score ( $\geq 6$ versus $< 6$ )	2.18 [1.27, 3.75]	0.005

\* Hazard ratio is per unit decrease

Place patient label or complete information below:

Name: \_\_\_\_\_ MRN: \_\_\_\_\_

\_\_\_\_\_ DOB: \_\_\_\_\_

\_\_\_\_\_



Transcatheter Heart Valve Program

Stanford Health Care

## Baseline Frailty Assessment

Date: \_\_\_\_\_

Height: \_\_\_\_\_ cm

Weight: \_\_\_\_\_ kg

BMI: \_\_\_\_\_

BSA: \_\_\_\_\_

Albumin: \_\_\_\_\_

Date collected: \_\_\_\_/\_\_\_\_/\_\_\_\_

### Katz Index of Independence in Activities of Daily Living

Points	Independent (1 point) NO supervision, direction or assistance	Dependence (0 point) WITH supervision, direction, assistance or total care
Bathing Points: __	(1 POINT) Bathes self completely or needs help in bathing only a single part of the body such as the back, genital area or disabled extremity.	(0 POINTS) Needs help with bathing more than one part of the body, getting in or out of the tub or shower. Requires total bathing.
Dressing Points: _	(1 POINT) Gets clothes from closets and drawers and puts on clothes and outer garments complete with fasteners. May have help tying shoes.	(0 POINTS) Needs help with dressing self or needs to be completely dressed.
Toileting Points: _	(1 POINT) Goes to toilet, gets on and off, arranges clothes, cleans genital area without help.	(0 POINTS) Needs help transferring to the toilet, cleaning self or uses bedpan or commode.
Transferring Points: _____	(1 POINT) Moves in and out of bed or chair unassisted. Mechanical transferring aides are acceptable.	(0 POINTS) Needs help in moving from bed to chair or requires a complete transfer.
Continence Points: _____	(1 POINT) Exercises complete self-control over urination and defecation.	(0 POINTS) Is partially or totally incontinent of bowel or bladder.
Feeding Points: _	(1 POINT) Gets food from plate into mouth without help. Preparation of food may be done by another person.	(0 POINTS) Needs partial or total help with feeding or requires parenteral feeding.
Total Points: _____		

Adapted from Katz S., Down, TD, Cash, HR, et al. (1970) progress in the development of the index of ADL. Gerontologist 10:20-30

Revised 5/4/15 DSC

**Grip Strength:****Left Hand**Dominant Hand: ☐ Yes

Grasp 1: \_\_\_\_\_

Grasp 2: \_\_\_\_\_

Grasp 3: \_\_\_\_\_

Average: \_\_\_\_\_

**Walk test:****15 Foot Walk:** \_\_\_\_\_ seconds

\_\_\_\_\_ seconds

\_\_\_\_\_ seconds

**6 Minute Walk Test (For MC):** \_\_\_\_\_ ft☐ Unable to perform walk test due to: \_\_\_\_\_**Use of wheelchair?** ☐ Yes ☐ No**Has the patient had a fall?** ☐ Yes ☐ No

\_\_\_\_\_ How many falls in the past 6 months? \_\_\_\_\_ times How many falls

\_\_\_\_\_ in the past 1 year? \_\_\_\_\_ times

Completed by: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Other Comments: \_\_\_\_\_

Gender	BMI	CutOff
Male	≤ 24	≤ 29
	24.1 - 26	≤ 30
	26.1 - 28	≤ 30
	> 28	≤ 32
Female	≤ 23	≤ 17
	23.1 - 26	≤ 17.3
	26.1 - 29	≤ 18
	> 29	≤ 21

Gender	Height	CutOff
Male	≤ 173 cm	≥ 7 sec
	> 173 cm	≥ 6 sec
Female	≤ 159 cm	≥ 7 sec
	> 159 cm	≥ 6 sec

## Summary: Economic Considerations

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- Although the PARTNER B trial demonstrated that TAVR is reasonably cost-effective for patients with severe, inoperable AS, these results are sensitive to several key parameters/assumptions
- In particular, TAVR is not an economically attractive treatment when...
  - *Life expectancy after TAVR <2-3 years*
  - *TAVR is expected to result in minimal QOL improvement*

## Summary: QOL Considerations

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- For most patients who are currently considered for TAVR, QOL outcomes are at least as important as improved survival
- Although no single risk factor is predictive of TAVR outcomes, validated risk scores can be developed that provide reasonable discrimination of long-term outcomes that integrate both survival and QOL
- Since currently available models provide only moderate discrimination (c-statistic  $\sim 0.65$ ), it may not be possible to identify patients for whom TAVR is expected to be truly “futile”